BEFORE THE

FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Public Notice. Spectrum Needs for the Implementation of the Positive Train Control Provisions of the Rail Safety Improvement Act of 2008	 DA No. 11-838 WT Docket No. 11-79

Filed on ULS in the captioned docket.

SkyTel Summary Position
on Spectrum and Wireless for Railroads, Including for PTC
With Further Documentation Related to the September 16, 2011 Meeting with FCC

On September 12, 2011, Warren Havens for SkyTel, the undersigned entities, SkyTel legal counsel, and Ron Lindsey of Communications Architecture, met at FCC offices with FCC staff. On September 16, 2011, the undersigned submitted a report of the ex parte presentations at the meeting.

The instant submission provides further information on the subject matters presented at that meeting: (1) SkyTel's summary position, and (2) an attached series of articles by Mr. Lindsey in his publication "Strategic Railroading" with notations by SkyTel.

Respectfully submitted, September 25, 2011,

Warren C. Havens
President of each of the following entities

Skybridge Spectrum Foundation
ATLIS Wireless LLC, V2G LLC, Environmentel LLC, Verde Systems LLC
Telesaurus Holdings GB LLC, Intelligent Transportation & Monitoring Wireless LLC

2509 Stuart Street
Berkeley California 94705
www.scribd.com/warren_havens/shelf
510 841 2220 x 30 – phone / 510 740 3412 – fax

- I -

Railroad Spectrum:
Myths, Audit, "Reallocation," etc.

The passenger railroads do not really seek 217-222 MHz: SkyTel offered it many times, even for free, but they do not respond. Nor for "interoperability" or "coverage" do they need this range spectrum (indeed, this one band works is inferior: see section II below). These are superficial myths. The myth become actionable attacks at least when, in addition, they propagate with PTC 220 LLC the suggestion that Congress effectively mandated that they use this spectrum, and thus they must have it by "reallocation" or any other means.[1] Further, this in the name of intelligent transportation systems ("ITS") that is short on spectrum. (PTC is part of ITS and these railroads stretch their suggestions of what PTC really is, to mean other things also for new railroad ITS.)

PTC 220 LLC and these railroads should "take their own medicine":

1. Audit and reallocation. Under these railroads' assertions of lack of spectrum and need for much more, an audit should be done of the real current use by railroads of radio spectrum (PLMR 160, 400 and 900 MHz, and other bands to some extent: N-LMS, unlicensed, commercial, Part 101, etc.). What is not well used with modern spectrum-efficient technology and construction architecture should be "reallocated" to other ITS uses, which may include future PTC if and when the railroads are actually ready to implement this (it is a simple wireless

[1] Some expressions of this falsity propagated by many railroads *and their law firms* before but also well beyond the FCC (of which there is ample proof) effect SkyTel and others in the market as well as in FCC proceedings, and may be actionable in court including under tort and antitrust law, and the Communications Act and other federal law. SkyTel has objected to these railroads and law firms of these matters, and do so again here. These potential claims are not subject to Federal preemption or the *Noerr Pennington* doctrine. These false assertions were also the basis of the SCRRA-PTC 220 LLC position before the FCC backing acquisition of the AMTS spectrum of Maritime Communications/ Land Mobile LLC ("MCLM") subject of revocations and sanctions in FCC 11-64 and the Hearing thereunder. As SCRRA and PTC 220 LLC know (since SkyTel directly showed them), SkyTel entities were the lawful high bidders for this MCLM spectrum. This is reflected in FCC 11-64 together with the relevant Auction 61 license applications and bidding results documentation.

data application, not a radio service). Other broader ITS has far more need then railroad PTC or than railroad wireless in total. This includes wide area spectrum to pair with DSRC for nationwide highway and roadway ITS, for vehicle to vehicle (VANETs- see Part II below), and vehicle to roadside uses. (See Part II below as to a Network of Systems for ITS.)

Also, if the audit finds that these railroads and their law firms mislead the FCC in their assertions of lack of spectrum and need for much more, the FCC should make a finding of lack of candor and take appropriate action, and should not accept bald or unsupported assertion in the future (and not cause others, like SkyTel, time and trouble by commencing many dockets based on unsupported assertions).

2. Reallocation of railroad spectrum internally. PTC 220 LLC, by the terms of its 220 MHz licenses (see them on ULS), had to meet certain build out requirements including under FCC-rule waivers. It informs the FCC that it will meet the requirements, although behind in time, by using this spectrum for PTC wireless, *but when its buildout report are read for actual content, they do not assert or show a plan, or actions, to use this for PTC per se.* (Also, this was *not* bought for PTC in the first place, contrary to representations by PTC 220 LLC in its FCC filings under its licenses.) PTC 220 also states under its licenses and buildout plan that it plans to lease some of this to other railroads outside of PTC 220 LLC, thus, it is clear that PTC 220 has more spectrum than it needs (the PTC 220 LLC members need).

Thus, these passenger railroads should seek this PTC 220 LLC 220-MHz spectrum since:

(i) PTC 220 LLC does not need it all, and

(ii) it appears to not meet FCC requirements to hold it, and

(iii) PTC 220 backs these passenger railroads' spectrum "reallocation" requests.

By their own FCC assertions, they need not pay PTC 220 LLC for this. And PTC 220 backs these assertions also.

If PTC 220 LLC spectrum goes to the government passenger railroads, they may help out private PTC 220 LLC (Warren Buffet, et al.. owners) by leasing some of the spectrum to the freight folks, since private freight rail may serve some government public interests.

On the other hand, perhaps private freight railroads are "too big to fail" and government should give them whatever they demand and not ask real questions? That appears to be the position of PTC 220 LLC and public passenger railroads tagging along. It is an especially dangerous time to go down that path.

- II -

Spectrum and Wireless System Solutions
for Railroad Wireless including PTC
In the Context of Broader Intelligent Transportation System Wireless

SkyTel asserts compelling legal, technical, economic, and public-interest bases for the following. This summarizes key elements of SkyTel's review of and presentations in this FCC docket 11-79, as well as in related FCC dockets regarding (i) AMTRAK seeking "waivers" to use AMTS from Maritime Communications/ Land Mobile LLC ("MCLM") (re MCLM, also called "Maritime," see FCC 11-64, and docket 11-71), and (ii) re SCRRA seeking MCLM AMTS spectrum (in three proceedings: the assignment application petition to deny proceeding, the related docket on that, and under a footnote in FCC 11-64),[2] and others.

1. US Railroads currently do not seek or need nationwide or regional standalone PTC wireless.

[2] These three proceedings, nominally with SCRRA as the requested beneficiary, were in turn proxies for PTC 220 LLC and other US railroads, as they stated in the proceedings, on their PTC "march to the sea" to "occupy" this lower 200 MHz band by "reallocation" or other means, using "big guns" in DC (in a FOIA obtained document), under alleged Congressional mandate, public safety intentions, and real plans for PTC. Pleadings in these proceedings contain the quoted revealing terms.

2. US Railroads will benefit from, and are seriously lagging (verses other nations, and wireless in general) new multi-purpose wireless, which will cost effectively support PTC, and overall will make rail more safe, efficient and competitive.

3. This needs to use modern tech and architecture: SDR (and also Cognitive Radio ["CR"] and Cognitive Radio Networks ["CRN'], which are now practical), multiple bands (no one band will "do it all" due to greatly varying coverage, capacity and other characteristics), multiple protocols, etc. *Trains are especially suited to all of this due to having the space and electric power for it, and antenna platform, etc.*

4. US railroads *need leadership* in this-- the same persons with a change, or new persons-- that will not play games (that they are going to build stand alone PTC, that the must have 220-MHz range spectrum for it, that they are equivalent of national defense, that Congress effectively forces them to get 220 MHz and do standalone PTC, etc.)

5. The *FRA needs to obtain and use objective* expertise in these areas, not aligned with private rail interests, or public rail that tags along under fear, side deals, or ignorance.

6. The FCC should require *real demonstrations:*

(1) first, what is rail doing with its current (and freely allocated) 160, 400 and 900 MHz, and its other spectrum (see Part I above- audit, etc.), and

(2) then, what is its plan or plans (when it has any) for new wireless for which it asserts need for more spectrum-- the coverage / buildout and capacity plan (which includes radio and antenna tech, baseband SDR etc, deployment architecture in initial and mature stages, etc.) -- and what are alternatives. This is far from a simple matter. There is no indication in this docket (or the above-noted related dockets) of such a plan existing now, nor one that is in the works. They speak of wireless with decades-old perspective and terms, which is like talking of commercial wireless now in terms of 2-pound 1-G cellphones and 1G spectrum waste. They do

not even have or plan 1G trunking. (See, e.g., Ron Lindsey's Powerpoint attached to SkyTel's September 16, 2011 ex parte presentation report in this docket.)

7. SkyTel summary plan. SkyTel does not depend on rail and does not court favors (obvious in this and related docket), but Skytel does have a clear plan that is demonstrable good for Intelligent Transportation Systems (ITS) nationwide, *including for Railroads:* In sum:

(1) Use of some LMS 900 MHz, some 217-222 MHz, and some 35-50 MHz: each has special strengths the others do not. And use SDR, CR, CRN, VANET, MBC etc.

- 900 MHz is better for higher capacity, urban, hand-portables, spectrum reuse, etc.

- 200 MHz is better (all else equal) for long-range corridor coverage beyond urban areas, where capacity is not as great, and to back up 900 MHz in urban areas to some degree.

- (Bands in between can be used also: see below.)

- 35-50 MHz is far better for very wide area coverage in 80% of the nation including any remote areas otherwise not possible to cost-effectively cover, and for another backup layer to the 200 and 900 MHz every where. This band supports meteor burst communications (MBC) (up to 1,000 miles per link or more)[3] and well as very long-range terrestrial links even with one hop, and extended by vehicle ad hoc networks (VANETs).

- VANETs can be used in and among all these bands.

- Use now-available High Accuracy (sub-foot, all the time) Location (HALO) methods: N-RTK, R-GPS, INS, etc.[4]

---

[3] See SkyTel filings in FCC docket 06-49, substantially discussing MBC including for nationwide ITS citing leading ITS and communications authorities. There is no comparable solution for truly ubiquitous coverage to large vehicles, and for redundancy in all cases. See also SkyTel papers on Scribd (MBC public folder): *www.scribd.com/warren_havens/shelf*

[4] See SkyTel filings in FCC docket 06-49, and those on Scribd, noted above.

- Work with power utilities to build and operate. They may do so, for use of some network capacity.[5]

- Use a Network of Systems approach: in one network using the above, various ITS segments can control on secure basis their own sub systems.

- *Each sub-system's extra capacity will back up others in emergencies. And overall, this will produce a far stronger network, economies of scale, better tech and equipment market and future, etc.*

(2) SkyTel has the spectrum in all these bands for nationwide ITS on the above-noted basis. It is proceeding with this, including to a large degree (including via Skybridge Spectrum Foundation) on a nonprofit basis, to assist with government goals of ITS. Power utilities and certain major tech-equipment companies have interest, etc.

(3) In such a plan, railroads could also use all of their current FCC licenses and bands. They may pursue the above or a plan like *with or without* SkyTel.

- But SkyTel and other transport-based ITS wireless can gain by working together in a Networks of Systems or other substantial cooperation arrangements, including Cognitive Radio systems (not just Cognitive Radios).

- The FCC has been clear, with sound technical reasoning and clearly in the public interest, that spectrum regulation and use must move toward implementation of the spectrum-efficient concepts noted above, including in the Spectrum Task Force report and in many other proceedings.

---

[5] E.g., see the SkyTel initial survey here: http://www.scribd.com/doc/49797709/Smart-Energy-Transport-Wireless-2010-Survey-of-70-Power-Utilities-Shpigler-Group-for-ATLIS-Wireless . SkyTel has progressed this plan.

- Railroad stand-alone PTC is not economically feasible (nor really planned) and Railroad wireless in total does not appear able or willing independently take these on, at least not with current vision and motivation. In any case, ITS Networks of Systems has advantages.

(4) Involve credible railroad communications expertise such as from Mr. Ron Lindsey (identified above). Be candid before the FCC, FRA, and general public-- its money and interests are ultimately at stake. Publicly debate issues.

/ / /

SKYTEL adds text in boxes: SkyTel's views, not meant to explain Mr. Lindsey's articles. SkyTel adds red side bars also.

These articles at: http://strategicrailroading.com/

Advanced wireless for railroads and all transport sectors is important, but PTC standalone wireless is not practical, nor is it really being planned by railroads, despite use of PTC it as a fishing lure at the FCC for spectrum and at Federal and State funding sources for money.

(Likewise, the PTC 220 LLC buildout plan to the FCC suggests it is for PTC, but it is not [read it, and compare to other PTC 220 filings] and its build out plan, based on that is flawed. If one traces the orginin of its various 220 MHz, such as from SMR Managemnet-Bizcom etc., this has like flaws- reality vs what is represented to get-keep the spectrum.)

That is misuse of the Metrolink train accident that caused Congressional PTC mandate, like misuse of 9-11-2001 for unjust private gain at expense of the public.

Real Intelligent Transportation System (ITS) wireless needs multiple spectrum bands, multiple protocols, have diverse applications and serve many transport sectors in various (and same) places and times-- like commercial wireles, but in a grade of tech, equip, coverage and service appropriate for ITS.

The main problem in ITS is the same as in government and law: too few willing to pursue open honest solutions in the public interest and stand against nonsense by too many vested interests. However, that is the way forward.

SkyTel approaces ITS wireless in this way, including spectrum and resources for support of government-based ITS programs (much on a non profit basis via Skybridge Spectrum Foundation).

Strategic Railroading

A Technology Strategy in-sync with an Operational Strategy

Don't Drink the Kool Aid

September 24th, 2011 | Author: Ron Lindsey **

The elixir of fatuous rationalization being served up by PTC-220,LLC to gain more spectrum in the name of PTC has been poisoning the efforts of both freight and passenger operations to cost-effectively meet the mandated implementation of PTC before 2016.

Point 1: In May 20011, the Federal Communications Commission (FCC) of the U.S. released WT Docket No 11-7, with Public Notice, regarding the "Spectrum Needs for the Implementation of the PTC Provisions of the Rail Safety Improvement Act of 2008". Subsequently, in addition to my written response, a number of submissions were made by various parties, most notably several passenger operations and PTC-220, LLC (the entity owned by BNSF, CSX, NS, and UP that owns and manages the 220 MHz spectrum to be used for the implementation of PTC). The FCC's Docket was the result of the request by PTC-220 to obtain additional spectrum in the same band reportedly to service both the freight and passenger rail requirements of the PTC mandate.

Point 2: At the end of 2010, the Federal Transit Authority (FTA) released several RFQ's for studies to be performed relative to PTC and CBTC. The primary study was to evaluate the issues associated with implementing PTC on commuter and regional rail systems. As I will be explaining in a posting I will be making shortly, this effort by the FTA is a very pathetic example of how a Federal agency can spend a fair amount of money and achieve nearly nothing of interest to the intended recipients. The proposal was poorly written as to both objectives and understanding of the subject, along with a process for evaluating and awarding the contract that was clearly inappropriate and unfair. (Yes! My team's proposal was not selected. But, I will explain the madness of the process in the forthcoming posting). The point for now is that in preparing the proposal, my team discussed the wireless issues with a number of passenger operators and gained some understanding in a very short period of time as to the concerns that they have as to the use of 220 for PTC.

* SkyTel funded Mr. Lindsey to present PTC relevant matters to the FCC objectively as he ultimately decided, including by inviting others from the rail industry in meetings at the FCC. See filings in this docket. No other rail industry parties to date have accepted this. SkyTel offerred 217-222 MHz and 900 MHz spectrum to railroads for PTC but none had interest, on any terms (even for free). See filings in this docket.

To be addressed in greater detail in the forthcoming issue of my quarterly journal, Full Spectrum, titled Wireless Gone Awry, I will highlight below a number of points as well as statements that PTC-220 made in their submission to the FCC's Public Hearing, that are critical to understand in consideration of providing more 220 to PTC-220.

- First of all, I am not saying that PTC-220 is incorrect in requesting more spectrum if they really need it. However, by their own admission, they really don't know what they need in that they have not done any credible data modeling relative to PTC. They are spectrum hungry and may even be looking at this spectrum as a "for profit" operation for dealing with the passenger operators.

- In their submission, PTC-220 likened PTC to advanced traffic control / management systems and the need for complex wireless networks to service the latter. I find such a comparison either to be shamelessly naïve or quite devious.

- The passenger operators have been led to believe by PTC-220, reportedly, that they must obtain 220 specifically for their own property to be compatible with the freight railroads. Hence, from some of the submissions by passenger operations, it appears that they were pressured, or unfairly influenced, to support PTC-220's position. The requirement to use 220 only is clearly incorrect and could be very costly for those operators that will be extremely pressed to find the public funds to implement PTC.

- PTC-220 states that they had engaged TTCI (which is operated by the AAR and hardly free of conflict of interest), to perform data modeling nearly 6 months prior to the submission, and yet there were no results that they could include in the submission. Really? I have team members that could handle that analysis quite quickly.

- The onboard PTC platform, a.k.a. TMC, incorporates a Mobile Access Router (MAR) that supports the use of alternative wireless paths, including 220, WiFi, and cellular.

- The rail industry is poorly utilizing a fair amount of spectrum, including conventional 160 MHz instead of trunked operation, 44 MHz now owned by PTC-220 and which was the choice of BNSF for PTC, and 900 MHz that was given to the railroads 2 decades ago to do ATCS. ATCS was never implemented and the railroads have used the spectrum for business purposes instead of giving the spectrum back (BTW, using 900 for code line is a business decision and not a safety one).

In summary as to the above, PTC-220 should be required to define their requirements clearly and with the proper level of legitimate data analysis done by an independent entity. As a point of further consideration, there is also a need to break down that requirement as to the type of traffic control involved as well as traffic density. For example, deploying PTC across dark territory has a substantially different wireless requirement than deploying PTC across signaled territory with either medium or heavy traffic volumes. In short, there is a need to identify various PTC "wireless corridors" as to throughput and coverage requirements, and to

model them individually.

In addition to my initial submission, I made a subsequent submission commenting on the falsehoods and misrepresentation that were made in some of the other submissions, most notably PTC-220. Additionally, 2 weeks ago I made a presentation to the FCC to provide them with a modicum of rail domain knowledge that would assist them in understanding the true requirements of wireless for PTC.

Both of my submissions as well as the presentation to the FCC were on a fee basis for a client, Skybridge Foundation. SBF placed no restrictions on what I wrote / presented, and did not interfere with the objectivity of my material. Both of those submissions and a PDF of my presentation are of public record and can be obtained via the FCC's website or by emailing a request to me at comarch@aol.com. Additionally, those individuals that seek to further understand wireless corridors are encouraged to contact me on that topic as well.

Posted in Positive Train Control (PTC), wireless | Tags: 220 MHz, FCC, Lindsey, Positive Train Control, PTC, PTC-220, railroad | No Comments »

Risqué Assessment – PTC

July 19th, 2011 | Author: Ron Lindsey

In designing and implementing safety systems, risk assessments are made to identify and mitigate unsafe situations so as to ensure a certain level of safety is achieved (a level of risk is not exceeded). For traditional railroad signaling systems, each supplier in the North America has developed its individual qualitative approach referred to as V & V (validation & verification) for evaluating their respective systems. That is, the V&V process is meant to *validate* that the right thing is being done, and then *verify* that it was done correctly. For electrical / mechanical components and systems, such an approach makes sense. But, when a most complex and highly unpredictable variable such as the human is introduced as part of the system, then the V&V process is not sufficient; the risk assessment process becomes much more risqué.

The design and implementation of Positive Train Control (PTC) has taken the traditional signaling suppliers outside of their comfort zone for risk assessment. With PTC designed to prevent the failures of humans to operate their trains within the limits of the active movement authorities, means that a *qualification* process has to be complimented with a *quantitative* process as well. But, if humans are so unpredictable as to both the types and occurrence of errors that can be made, then how can even a quantification process be established? Actually, the process is quite straightforward. It's a matter of simulating the environment to be evaluated over an extensive period of time and/or iterations, and to use historical data as to the type and degree of threats that may occur. The reason for the extensive time period and/or iterations is to provide for the randomness of events so as to ensure a statistically sound analysis.

Risk relative to evaluating PTC was defined by the Railroad Safety Advisory Committee (RSAC) to be ***the severity multiplied by the likelihood of the train being coincident in time and space with an unsafe condition.*** RSAC was composed of a mixture of regulators, rail management, labor, and supplier personnel, and one of their responsibilities was to evaluate a risk assessment process that was being specifically designed for PTC. Referred to as the Axiomatic Safety Critical Assessment Program (ASCAP), this tool was to be a very straightforward simulation program that could have readily provided a more than adequate

analysis of PTC reducing risk – which everyone already intuitively understood anyhow. I mean, if PTC eliminates the most dangerous source of train accidents, again human errors, then it's a winner (assuming it doesn't introduce any significant risk – and it doesn't). Of course, the regulators can't accept intuitive analysis. They need the mathematical proof, and hence ASCAP.

You noticed that I said that ASCAP ***could have been*** a great tool. But, it failed to be delivered due to extremely poor management of resources. I am not referring to ASCAP's developers, but rather to involvement by the RSAC participants that continuously battered the developers with "insights" and additional requirements of how to make the ASCAP simulate a railroad to the greatest exactness possible. What they failed to understand was that the error associated with simulating human-based events was much greater than correcting for the acceleration of a sample train from a railroad yard, for example.The bottom line here is that the RSAC advisors who were lacking in sound mathematical principles, including Operations Research (OR), and simple pragmatic analytical tools turned a straightforward simulation tool into an unachievable, complex quagmire of code. What was missing was a manager experienced in OR with railroad domain knowledge that could have separated the RSAC's advisors appropriate advice from the fatuous comments.

ASCAP failed due to poor management and not due to its concepts or principles. Simulation is a quantification risk assessment approach that eliminates the risqué-ness in risk assessment processes involving humans.

Posted in Positive Train Control (PTC), Signaling | No Comments »

PTC Interchangeability

July 12th, 2011 | Author: Ron Lindsey

The concept of interoperability is relatively new to the rail industry as railroads link their operations within and across country boundaries. In fact, the lack of interoperability between various European countries in the past century was a purposeful defense mechanism against invading armies that could use railways for rapid, massive troop and weapon movements. Now, interoperbility has been the driving force for deploying ETCS across Europe for the past decade or so. And in the U.S., interoperability is currently the most costly and exasperating aspect of delivering Positive Train Control to meet the U.S. government's mandate of it being implemented across most of the country's trackage before 2016. Specifically as to PTC, the Interoperable Train Control (ITC) committees that are primarily manned by CSX, NS, UP, & BNSF have been working intensely to address issues such as system architecture, on-board functionality, message set, communication network, data management, and an all-encompassing method of operation. However, what has not been addressed is dealing with the set of parameters that provide for ***interchangeability***, i.e., the ability to exchange a component or entire on-board PTC unit when not on the owning railroad's property. Actually, this can even be an issue within an individual railroad as is currently the case with one Class I railroad that has an inventory of on-board units with 8 different model #s. Clearly, as the railroads begin to implement PTC, the challenges of interchangeability, and hence the costs, if not handled properly very soon, are going to grow exponentially.

The parameters of interchangeability include the physical dimensions, electrical interfaces, as well as ensuring software and hardware compatibility at both the component and platform level. Perhaps some folks think that the issue of PTC interchangeability will not be that significant given that Wabtec is the only supplier of the on-board Train Management Computer (TMC). However, that point is quickly dismissed based upon a number of other considerations, including

- Other suppliers are looking to compete with Wabtec as to the TMC;
- Again, one Class I railroad already has 8 different model #'s for the Wabtec TMC;
- Railroads will want to ensure that a foreign unit is properly configured as to software and hardware;
- Railroads will want assurance as to a long-term supply of components and units;
- There is a vast number of individual locomotive configurations;
- Proprietary backplanes work against the railroads' best interests in most cost-effectively deploying on-board systems;
- Lastly, given that industry politics seemingly are always at play, there are bound to be conflicts within the "standards" that are being provided by ITC. BTW, what about the one most critical standard that is not being provided by ITC. I refer to the TMC source code. More on this latter.

Volume 59 of my quarterly publication, ***Full Spectrum***, that will be released around October 1st this year, will be addressing interchangeability in substantial detail as to the challenges and the opportunities.

Posted in Positive Train Control (PTC) | No Comments »

Six Wireless Decisions Your Wireless Management Shouldn't Make

June 9th, 2011 | Author: Ron Lindsey

In the November 2002 issue of Harvard Business Review (HBR) there was an article titled "The Six IT Decisions Your IT People Shouldn't Make". It was a great article about how Operations management for so many companies have abdicated responsibility for IT decisions to IT executives, thereby resulting in a significant loss in the return on their IT investments. The underlying truth is quite straightforward. That is, Operations management "failed to recognize that adopting systems posed a business – not just a technological- challenge. Consequently, they didn't take responsibility for the organizational and business process changes the systems required." The result of this lack of involvement was that the CIO, with a technology perspective exclusively, was constraining the advancement of the company's business processes, and most likely the return on IT investment and, more importantly, the company's bottom line.

Shift now to railroads and their nearly total dependence on managing mobile and remote resources. In this environment, the strategic IT environment extends to the "mobile node", the locomotive platform, by incorporating a strategic wireless data perspective in sync with the IT strategy. And, has been so unfortunately demonstrated in the North American railroad industry, it's the wireless technicians that are constraining the advancement of business processes by their pursuit of non-strategic wireless networks, most recently in the name of PTC. I refer specifically to the intended deployment of the 220 MHz band in parallel with the 160 MHz band that will be shifting to a digital platform to meet the FCC's narrow-banding mandate. In line with the HBR article, the railroads' Operations management have not been involved with the evaluation of how wireless technologies will be deployed. I stress that it is not the technicians' fault that

they have such a free hand, but rather that of the railroads' upper management that have failed to be involved.

Paraphrasing the key points of the HBR article, below are the 6 decisions that a wireless manager should not make about the deployment of wireless technologies, from both a strategy and execution standpoint.

Strategy

- How much should we spend on wireless?
- Which business processes should receive our wireless dollars?
- Which wireless capabilities need to be company-wide (and industry-wide)?

Execution

- How good do our wireless services really need to be?
- What security and privacy risks will we accept?
- Whom do we blame if a wireless initiative fails?

Via several following postings to this blog, I will address some of these questions in greater detail.

Posted in Railroad Business, Strategic Core Technology, Strategic Railroading, wireless | No Comments »

Risk Credits

May 11th, 2011 | Author: Ron Lindsey

With a cost / benefit ratio of 20/1, there is no incentive for railroads to implement PTC on their own. As discussed in a number of postings on this blog, there are no business benefits provided by PTC ***directly***, in that PTC has nothing to do with the efficiency of traffic management. Some folks are still confused on this point in that they refuse to accept the fact that it is the wireless data system that PTC requires which can deliver data required for advanced resource management, as in "Where is my train and how fast is it moving". PTC is just one user of the wireless network. This point has been well demonstrated by Norfolk Southern, that by means of a simple wireless data system, is currently implementing proactive traffic management before and without PTC. However, there is, or rather there was before the mandate, a possibility of railroads to achieve ***indirect*** business benefits from the deployment of PTC.

Prior to the mandate, there had been some possible movement in the FRA to consider the overall risk of a track segment as to whether or not a combination of changes could be made that may have a ***NET*** decrease in risk even though one or more of the changes may actually increase risk, e.g., removing signals that were no longer required … or … making the transition to one-man crews. HOWEVER, by implementing PTC in

concert with doing either or both of those would result in a net decrease in risk given the safety value of PTC that prevents train crew errors. Therefore, prior to the mandate, implementing PTC provided the railroads with the possibility to implement other projects of significant business value that may not have been accepted by the FRA otherwise. With the mandate, the railroads no longer have that bartering position … or maybe they do.

Jumping to the present, and again thinking about the PTC mandate and the phenomenal cost for which the railroads so far are near-totally responsible, then perhaps a concept can be brought to the table to ease the financial blow of the knee-jerk PTC mandate by Congress due to the Metrolink-UP accident in September 2008. I am referring to the railroads being given ***Risk Credits*** relative to their degree of PTC implementation. That is, for every segment of PTC installed, then the railroads get a certain amount of risk credits to use for the pursuit of other activities that may be deemed to increase risk, but provide substantial business benefits, again one-man crews, removing signals, whatever. Such credits, like pollution credits, may even be tradable between railroads by those who don't need the credits and those that could use them. Hmmmmmm! Great Idea, me thinks. Spread the word.

Posted in Positive Train Control (PTC), Railroad Business | No Comments »

PTC Spring Sale – 80% off

May 11th, 2011 | Author: Ron Lindsey

ACT NOW! Don't wait any longer. This is your last chance opportunity to get PTC before the technicians take your railroad to the edge of the PTC investment abyss and give you the financially-fatal push.

The PTC approach being pursued by the Class Is via the Interoperable PTC Committee (ITC) manned by CSX, UP, BNSF, and NS, is tremendously overdesigned as to functionality, technology, and infrastructure. The net of this is a 5-fold increase in investment (my estimate). However, it still is not too late to scream " I'm not going to take anymore!" and design your PTC implementation in a fashion to avoid most of the unnecessary stuff. Here's the story in 3 simple bullets.

- As was addressed in an earlier posting on this blog, ***YOY WIUs***, it is clear that the recent estimate of 50,000 wayside interface units (WIUs) that provide wireless data paths from wayside infrastructure components to the PTC client on the locomotive and the PTC server in the office is off by a factor of 60%, minimum. As explained in the earlier posting, WIU's are not required for Intermediary Signals (ISs) and control points. The former is not a required function of the PTC mandate (in fact, doing so may actually increase risk), and the latter can be done via the already installed code line.

- I find no evidence of anyone doing an actual data throughput analysis for PTC. From my personal experience, having been the architect for the first overlay PTC system that provided the foundation for the Class I pursuits, there is very little data throughput required (save track data base downloads that can be handled via WiFi in the yard). And yet, the ultimate wireless data system is being

developed by ITC. It is clear that PTC has nothing to do with this development in actuality. The railroad technicians want the network (they love the challenge), and perhaps someday they will need it (there currently is little to no strategy as to how the network could be used), and they are using PTC as the excuse.

- Complimentary to the above point, the railroads actually don't even need the 220 MHz network. What they failed to do several years ago was to use digital trunked radio technology to outfit the current analog 160 MHz infrastructure to meet the FCC's narrowbanding requirement. They are already switching that network from analog to digital, but they have chosen to use conventional radio instead of trunked. Granted it would have been a complicated transition, but $1 billion cheaper by avoiding the 220 MHz infrastructure. Again, the railroads' technicians took it upon themselves to address challenges without proper executive management understanding and oversight which would have required proper business case analyses.

The bottom line on the railroads' bottom lines is that the cost of PTC implementation could be reduced from the estimate $10 Billion to a mere $2 billion, give or take a $1 billion. But to take advantage of this Spring reduction, someone has to stand up now and say scrap the 220 MHz, install digital trunk 160 MHz, and ignore 60% of those WIU's. Of course that won't happen. What a shame.

Posted in Positive Train Control (PTC), Railroad Business, Strategic Railroading | 1 Comment »

Wireless for Railroads

April 18th, 2011 | Author: Ron Lindsey

Ron Lindsey was recently commissioned to write a white paper titled **" Wireless for Railroads"**.

The paper addresses the extraordinary opportunities railroads have, both individually and collectively as an industry, to advance their operations via the use of advanced wireless technologies, as well as to improve the efficiency of their spectrum usage. This perspective is expanded to consider the relationship of the freight rail industry with passenger rail, other transportation modes, and the intersection with public safety. This is a STRATEGIC PERSPECTIVE based upon identifying both the DEMAND for and SUPPLY of wireless technologies which provides the basis for structuring an approach for MOVING FORWARD.

The white paper will soon be available for download. But, to request an exclusive advance copy email Ron Lindsey at comarch@aol.com

Posted in Uncategorized, wireless | No Comments »

YOY WIUs ?

March 8th, 2011 | Author: Ron Lindsey

In a previous posting on this blog, ***Hey! Watch This***, I reported on some of the findings stated in the U.S.'s General Accounting Office (GAO) report on PTC dated December 2010. The bottom line of that report was that the cost / benefit ratio over 20 years for implementing PTC is hovering around 20/1; an absolutely unacceptable criteria for private investment. And yet, that is the burden, the cost of doing business, for the freight railroads it seems. For the commuter and regional rail systems that require public funding to stay in gear, the challenges of obtaining the necessary funding are likely to be even more severe. Given these circumstances, the question needs to be asked as to what can be done (other than obtaining Federal funding) to make the cost/benefit ratio more reasonable.

The opportunities to obtain a more reasonable cost/benefit ratio fall into three categories obviously, i.e., reduce the costs, increase the benefits, or do both. Until now, the only focus has been on increasing the benefits. However, as I have noted in the referenced posting, as well as others on this blog, there are no business benefits directly associated with PTC; PTC is only a safety-enhancement system. Those fatuous attempts by either naïve or mischievous individuals to identify business benefits have been rejected mostly by now, with only the occasional exception as discussed in my posting, ***Really! You Gotta Let It Go***. So, the safety benefits that have been identified for PTC are all that there are.

So! If the benefit denominator of the cost/benefit ratio can't be increased, then the only option is to decrease the cost numerator. Interestingly, there are three very significant ways to do that, although they still may not provide a reasonable cost/benefit ratio. The first possibility, again, has been addressed on this blog already. I am referring to tightly integrating the PTC platform with an IT / wireless data platform to provide a ***mobile node*** architecture for a railroad's management system just as a manufacturer would do with ***fixed nodes*** to manage its facilities. The second possibility to reduce costs is to go after the wireless infrastructure that is being developed by the Class Is. As also addressed on this blog, this network is a tremendous overkill for what is needed for PTC as currently structured. And as will be described immediately below, the wireless infrastructure is even more irrational if the third method of reducing costs is taken into consideration, i.e., significantly reducing the number of Wayside Interface Units (WIUs).

Why Oh Why the WIUs ?

The implementation of PTC requires 4 primary components.

1. On-board PTC platforms (clients);

2. A back-office PTC platform (server);

3. Wayside interface units that provide for the interchange of data between the critical wayside infrastructure components and the PTC clients / server; and

4. A wireless communication network to deliver the necessary data between the other 3 components.

There simply is no way to reduce the number of PTC clients or to eliminate the server. However, when it comes to the WIU's there is in fact a major opportunity to minimize the number of units required, that is if one doesn't accept what is being said by the industry. Specifically, the estimated number of WIUs that will

need to be installed to implement PTC across the U.S. has gone from 75,000 for shock value by the freight railroads following the mandate, to the current estimate of 50,000. Now, with the recent agreement by the Obama Administration to reduce the amount of trackage requiring PTC by 10,000 miles, due to changes in traffic by 2016, the estimated requirement for WIUs is probably now around 45,000. **But**, the kicker is that such a number is still way too high, at least from a regulatory standpoint.

To understand what can be done to reduce the WIU requirement first requires understanding the functionalities that are provided by the use of WIUs, as follows:

1. Reporting status of a manual switch to the PTC server for routing a train in dark territory;

2. Reporting status of a manual switch to the PTC server or clients for supporting enforcement of a train to prevent unauthorized movement through a misaligned switch;

3. Reporting aspects of the control points to the PTC server or clients so as to set up the "targets" for possible enforcement; and

4. Report aspects of the intermediary signals (ISs) to the PTC server or clients so as to set up the "targets" for possible enforcement.

There is a 5th functionality supported by the use of WIUs that is not directly associated with PTC deployment, i.e.

5. Permitting the operator to operate a switch remotely from the locomotive either within the train's authority if PTC is operable, or without checking for authority should PTC not be available.

Now, like everyone else, did you accept #4 regarding ISs without question? In fact, to incorporate ISs into PTC functionality is not a regulatory requirement of PTC. Additionally, not only does incorporating ISs into PTC not provide any true advantage, but one could argue that to monitor ISs could become more of a hazard than a benefit, as well as a source for decreased velocity, due to the increase likelihood of false enforcements.

> **Note:** the issue of false enforcements is primarily due to the significant variance in determining the braking curve necessary for enforcement, thereby possibly enforcing the train to a stop when it fact the operator could have managed to handle the train properly.

So, why have ISs been incorporated into the PTC platform? It all stems back, in my opinion, to one individual at one Class I who took the dark territory solution for PTC for which I was the architect at CSX, and put a non-pragmatic signal territory spin on top of it. However, it may go deeper than that it seems. Just as with the resistance that existed by Labor to reduce the trackage that requires PTC by 10,000 miles, as noted earlier, it seems that Labor has had its hands in the design of PTC as well. I guess it comes down to jobs. In short, not only is PTC not a rationally justified safety system, but there is an irrational level of infrastructure being required to satisfy Labor.

I am not quite through as to reducing the use of WIU's. I now look at point #3 as to the WIUs for control point. The point here is that the control points are already connected to the CAD platform via a wireless or wired pole line. These communication links provide the same data to CAD that are required by PTC. That means that WIUs are not required for control points either in that the code line infrastructure can be tapped by the PTC server at the back office to get the information required to generate targets. Wait, I am still not done with reducing the number of WIUs.

Consider point #2 as to ensuring no movement through a misaligned switch. This situation is somewhat

similar to the approach I developed for handling work gangs and the Employee in Charge (EIC), which by the way is the approach being used for PTC by the freight railroads. That is, the on board PTC client notifies the operator of the train's approach to a work gang and requests that s/he indicates via the on board PTC display whether or not s/he has approval provided by the EIC to proceed into the work zone. If no positive response is received by the PTC client within certain distance / speed / time parameters, then an enforcement is made. This same approach could be used to notify the operator of an upcoming switch and to request an input by the operator that s/he can verify that the switch is properly aligned. Again, as with the work gang, if a positive response is not received within a certain combination of distance / speed/ time, then an enforcement is made. While this approach may seem a bit awkward, it is in fact a solution that is directly aligned with the operating rules.

Finally, as to point #1, the use of WIU's for routing trains in dark territory. Actually, that one is still appropriate in that it was the solution I conceived for the development of PTC at CSX. As mentioned above, that PTC project was for dark territory and the other alternatives for routing trains at that time were too outlandish and/or too expensive, including the failed pursuit by the joint venture of GE and Harris to deploy **Precision** Train Control (not positive train control), a vital, moving block operation.

One last thought here. If indeed the railroads were to greatly reduce the number of WIUs based upon the above, then the cost of the wireless network would be significantly reduced as well, me thinks.

I await your comments.

Posted in Dark Territory, Positive Train Control (PTC), Signaling, wireless | No Comments »

Software Defined Radio (SDR) . . . defined

March 2nd, 2011 | Author: Ron Lindsey

At the PTC Congress last week in Miami, a Union Pacific (UP) panelist was asked about the real estate on top of the locomotive as to the placement of antennas in the light of the 220 MHz band that is to be used for PTC. The UP manager stated that, in fact, there can be up to 14 antennae mounted on a locomotive, and Yes! they are getting crowded. The number was quite a surprise for me in that my quick count could only come up with 10 (which is a pathetic number in itself), i.e., GEO satellite, 40MHz, 160 MHz-voice, 160 MHz-data, 450 MHz, 900 MHz, cellular, WiFi, GPS, and 220 MHz. Now, moving into the cab, the large number of antennae implies that there is a significant number of radio units mounted in nooks and crannies, with each unit most likely servicing singular applications with singular protocols via singular frequencies, e.g., voice, end-of-train (EOT), locomotive diagnostics, event recorder download, and distributed power.

Ah Yes! I can't help but think back just 20 years ago when railroad communications engineering was so straightforward. At that time, wireless on the locomotive was limited to voice radio with the introduction of EOT as the first major use of radio telemetry across the industry. Granted, railroads were even less efficient than they are today, but there was plenty of excess of everything, so what the heck? We didn't need wireless data to advance resource management processes. The big thrust then was the transition from crystals to the use of synthesizers to provide a full slate of channels on a single locomotive radio unit. While the railroads' communication forces may consider their expansion of wireless data technology since then to be progressive, as suggested by the locomotive's antenna farm, I view the transition as being totally tactical and not at all strategic. So! Is that being progressive … or is it just being evolutionary? The difference between those two perspectives is extraordinary. That is, the additional cost of being tactical instead of strategic includes an extraordinary amount of capital investment, maintenance, opportunities to delay trains due to inoperable equipment, as well as an extraordinarily poor IT architecture (both physical and logical)

due to the lack of system integration resulting in an extraordinary inhibiting of advancing railroad operations in a revolutionary fashion instead of an evolutionary one. By this last point I mean that railroads have failed to use wireless technologies to advance the management of their key resources from that of being reactive to that of being proactive, as discussed in other postings on this blog.

Unfortunately, the technicians have been free to do what they like to do most, i.e., design communication solutions that are tailored to specific applications. If they were asked to justify why they didn't consider pooling applications on a single radio, for example, they would have a number of seemingly good technical reasons, of which some would have some merit. However, the bottom line is that they have not been required to build a multi-function or multi-band wireless platform that would reduce many if not all of those extraordinary items mentioned above. This is where software define radio (SDR) comes into play.

With the term SDR being introduced as recently as 1991, it can most simply be described as replacing a number of hardware components of a radio unit with software. The underlying principle for doing so is the use of some form of digital signaling processers (DSPs) that can replace specifically designed hardware such as RF filters, mixers, amplifiers, and modulators/demodulators. While that sounds interesting, the truly great point is that a single signal processing platform can service an unlimited number of combinations of bands and protocols. It only needs the appropriate software; software which can be accessed instantaneously to provide a different radio platform to the same user.

The real breakthrough in SDR began with the rapid, exponential increase in the power of general purpose processors to service the PC market. Again, simply stated, that meant that a standard computer and the corresponding advancements in software programming could advance SDR much more rapidly than continuing to rely on the much slower advancement in specialized DSP technology. What better example of this is there than the iphone and its competitors that can handle multiple protocols, e.g., 3G, 4G, in a fashion transparent to the user?

It was a decade ago that I reached out to several companies that were then beginning to use the general purpose processors found in PCs instead of specialized DSP to deliver SDR to the military – industry complex. One such company accepted an invitation to present their concepts, using a laptop computer, to the AAR's wireless committee. They came, they saw, and they retreated. The interest by the railroads' technicians was one of moderate curiosity without any incentive to do anything different than what they were then doing to avoid the inevitability of meeting the FCC's narrow-banding push of the railroads' 160-161 MHz band. That was then, What about now? Interestingly, the answer is that the technicians have totally swung to the other extreme of the pendulum. That is, instead of spinning wheels to achieve nothing, they are totally involved in creating the ultimate wireless data network and thereby ignoring all other possibilities as to advancing technologies as well as alternative approaches to spectrum usage.

SDR is only one possibility for advancing the cost-effective and efficient use of wireless across the rail industry that will be discussed in future posts on this blog. For example, I will be addressing soon the software defined antennae (SDA), that in sync with SDR, provides the basis for cognitive radio.

Posted in wireless | No Comments »

Benchmarking Wireless

February 15th, 2011 | Author: Ron Lindsey

So many words, phrases, and processes that were used in 70s regarding computers have faded to the point that it is likely that few under 50 years of age would have heard of them, yet alone understand their usage. I

am referring to terms such as *core memory, thrashing, I/O bound, DP, TOS, DOS, boot strap, JCL, punched cards, re-IPLing, LCS,* and *core dump*. This was the era of mainframe computers with orders-of-magnitude less processing power and storage than available today at orders-of-magnitude higher prices. Indeed, as the phrase DP suggested, this was a period of batch processing of data, e.g., payroll or inventory update, versus that of dynamic generation of information.

Back then, one process in particular was extremely important when making decisions about the investment in computer systems. That is, customers would often require that a computer supplier to ***benchmark*** it's various levels of systems, or against competitor systems, to compare the efficiency and adequacy relative to the cost of those systems. In truth, having been actively involved in such activities as an IBM DP Marketing Representative, benchmarking was more often than not a shell game played by the vendors' System Engineers that tweaked each part of their computer parameters (constraints such as I/O speed, partition size, disk access speed, etc.) to maximize the throughput of a particular a system in favor of each customer's individual expectations. Getting the customer's order was often the result of the vendor's Marketing Representatives and System Engineers working together to set up the customer expectations and then to demonstrate the ability to meet them, respectively, euphemistically referred to as having *account control*.

With the move from back-office / mainframe computing to that of distributed client/server, the art and science of benchmarking has become that of legends for those still able to remember the good ole days. With seemingly unlimited computer power and communication links, there is rarely an issue today of whether or not the IT architecture will handle the requirements and at what cost. Over the last several decades the investment decision has shifted from costs/power to that of developing / obtaining the software relative to business value. Well, that's almost totally true. For industries that rely on substantial mobile and remote resources, advancing IT can also be a significant infrastructure and hardware cost as well and therefore worthy of benchmarking. Unfortunately, that continues to NOT be the case for railroads.

As I have noted in other postings on this blog, and in my quarterly publication, *Full Spectrum*, most of the major railroads in North America have failed to develop a strategic technology plan in sync with a strategic operations plan (*Strategic Railroading*™). What is not understood, and therefore not appreciated or evaluated by railroads, is the paradigm shift that can be made for these predominantly unscheduled railroads by increasing the accuracy and timeliness of the status of their key assets, including track time, locomotive diagnostics, fuel, crews, and yard occupancy. And, the primary technology to do that is wireless data. So, if companies found it appropriate to benchmark computer systems for the paradigm shift that they made in the 70s by replacing clerks with MIPS, then why are the railroads not doing the same in pursuing their deployment of wireless? There are two points to consider to address this question, i.e., MOTIVATION and PROCESS.

MOTIVATION

In the case of railroads with 1000s of locomotives and the possibility of incorporating them as *mobile nodes* on the IT architecture, as a manufacturer would consider *fixed nodes*, then there is definitely something missing. What is missing is the understanding by railroad management, and suppliers failing to taking a proactive position, of what can be done with IN-TIME data. I am not referring to REAL-time data. The difference between IN-TIME and REAL time is critical in understanding the constraints of using wireless data, versus the seemingly infinite capability of wired links as in a manufacturing environment. To be explained in a future posting, IN-TIME data for train speed and position information in unscheduled operations is no more frequent than every 5 minutes for other than moving block operations. Hence, the railroad technicians that are charged with designing wireless networks can't help themselves, nor are they held responsible, in making technical decisions which are not related to true business evaluation. Stated simply, technicians will always over design to make sure that they don't come up short.

PROCESS

As nearly everyone now appreciates with the proliferation of cell phones and laptop computing, wireless is clearly limited in its throughput speed and coverage. It has been an eye-opening experience for those folks that expected that their internet connectively on their cell phone and notebook would match their in-the-office-cubicle desktop performance. There are two primary ways to determine what needs to be done.

1. evaluate every possible wireless-based application as to data requirements and calculate the ultimate throughput requirements. At least one railroad tried this approach several years ago, and the process bogged down in detail thereby insuring nothing would be resolved.

2. evaluate on an 80/20 basis as to evaluating throughput requirements relative to a variety of wireless options recognizing the two key parameters of wireless data parameters. i.e. throughput and coverage. This approach was used a decade ago when I structured such a study that was participated in by the big 4 railroads in the U.S. with oversight by the AAR. The results of that study were used at that point by the AAR to justify the industry's usage of the 160 VHF spectrum to the FAA. However, that was all the farther it went. Basic details follow.

Developing a ***Wireless Strategy*** for a railroad, or for an industry, needs to be pragmatic and adjustable to each railroad's technical agenda, assuming there is one.

The process is rather simplistic in structure, but a true commitment is required by a railroad's upper management to provide the players involved with the proper motivation to address the bottom line at the same time. To be brief, the process requires developing a matrix that plays off THROUGHPUT requirements against COVERAGE. For railroads, the THROUGHPUT requirements may include simple categories such as Voice, Monitoring (locomotive diagnostics, shipment status), Out-bound Transactions (PTC targets), Process Control (moving block), and Interactive (M of W activities, in-train management). As to COVERAGE, the categories can be as simple as Terminal, Metropolitan (major cities with multiple railroads), Main Line, and Group (M of W gangs, Trains/Cars). Within each Throughput / Coverage block of the matrix, the possible applications are identified with a pragmatic evaluation of data requirements. This provides the Demand perspective.

The next step is to evaluate the various wireless data options, both commercial and private, as to their ability to service the demand. This is the Supply perspective that results in **Wireless Corridors**, if you will, that permits structuring a manageable number of wireless strategies based upon business evaluation as to costs vs. value. Such an analysis, in my belief, would have prevented the phenomenal, unwarranted investment in the 220 MHz spectrum that is being made in the name of PTC, even though the railroads are required to spend $100s millions to rebuild the 160 MHz infrastructure as required by the FCC by 2013.

For those small to medium railroads outside of North America that are being slammed with ETCS, and the requirement for GSM, the analysis goes even deeper. That is, as described in other postings on this blog, the use of dark territory (with or without PTC) and the deployment of cost-effective wireless solutions can provide substantially lower capital investments to run a railroad both safely and efficiently.

Bottom Line, railroads should be benchmarking the use of wireless technologies with a pragmatic understanding of both Demand and Supply. Further details of such a process can be obtained by contacting me to discuss individual situations. This is what I provide as a consultant.

SkyTel notes. In addition, coverage and capacity factor in many things, few of which are even indicated by railroads in presentations to the FCC. One-way coverage is based on S/N+I at remote radios (and radio tech sensitivity etc.), not 'S' per se and not the spectrum band per se. Two-way coverage adds other factors. Capacity factors in BER and various QoS needed or desired, and at various places and times. Coverage and capacity should be at projected maturity, and backed off to iniital stage. *Often, a plan focused on saving costs in initial stages (even if that is achieved) can add costs and hurt capacity at maturity-- the railroad's suggested 220 MHz nationwide narrowband plan (to the vague degree it is presented) appears headed to do just that. If they build it, it will be obsolute (vs. any thing that approaches state of the art) from the start.*

FOLLOW ME ON twitter

Strategic Railroading™

Given recent tech advances there is now an unprecedented opportunity to advance railroad operations and the integration of high speed rail with freight. Real-time traffic management and communication is possible without significant development and deployment costs, but it will take a technology strategy working hand-in-hand with an operational strategy, it will take Strategic Railroading.™

Full Spectrum - Quarterly Journal

Full Spectrum is a quarterly railroading journal authored by Mr. Ron Lindsey. The majority of executives in the US railroad industry, including top members of the FRA and the major railroads, have subscribed to Full Spectrum for the past fifteen years.

Full Spectrum subscriptions are available by contacting Ron via email. If you are concerned with staying abreast of the newest advances in rail technology or operations strategy, it is highly recommended you subscribe in order to maintain your competitive advantage.

Back issues are on sale here.

Purchase Full Spectrum Issues
Your cart is empty
Visit The Shop

Recent Posts

- Don't Drink the Kool Aid
- Risqué Assessment – PTC
- PTC Interchangeability
- Six Wireless Decisions Your Wireless Management Shouldn't Make
- Risk Credits

Categories

- Dark Territory
- Positive Train Control (PTC)
- Railroad Business
- Signaling
- Strategic Core Technology
- Strategic Railroading
- Teddy Bears
- Uncategorized
- wireless

Recent Comments

- Millard Mustin on Teddy Bear – There's nothing Vital in Dark Territory?
- Ben Irwin on PTC Spring Sale – 80% off
- Djoko Corovic on Full Spectrum
- Joern Pachl on Traffic Movement: Safety vs. Management
- Ron Lindsey on Traffic Movement: Safety vs. Management

Contact Us | Trademarks | Privacy Statement
Copyright © 2010 Ronald Lindsey. All Rights Reserved.